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A Survey of Dynamic-centric Bandwidth Allocation Technique for Wireless Networks

[1]Bakkiam David Deebak, [2]Rajappa Muthaiah, [3]K. Thenmozhi and [4]Pitchai Iyer Swaminathan
[1,2,4]School of Computing,
[3]School of Electrical and Electronics Engineering,
SASTRA University, Thanjavur, 613401, Tamil Nadu, India

Abstract: Objective of the study is to study and analyze the dynamic-centric metrics of bandwidth allocation and estimation for wireless networks. We also extend the objective to probe Quality of Service (QoS) provisioning guarantee for infeasible packet routing networking protocols. This study signifies the bandwidth sharing scheme for real time and non-real time based. So far, the researchers have not examined this signification to have a good impact on throughput rate, packet reception rate, packet dropping rate and packet delay. Nowadays, the network technologies have been focused much on dynamic bandwidth allocation for achieving effective bandwidth utilization, good service rate and improving service satisfaction. Thus, we study a lot of routing strategies to analyze the metrics of bandwidth. In the study, we find the convex optimization technique as suitable to enhance the network throughput performance, providing bandwidth issue is negotiated on network.

Key words: Throughput rate, packet reception rate, packet dropping rate, packet delay, dynamic bandwidth allocation

INTRODUCTION

Allocating the bandwidth in dynamic for wireless network often gives good resultant metrics. Although, the research on that has not been enormous for improving the significant metrics of the networks. Routing has a problem of delivering the data from one network to another by reasonable utilization of bandwidth. Today, it has become necessitated in all the latest mobile technologies and it is owing to '3 Anys'-Any person, Anywhere, Anytime (Prasad, 1998; Sampei, 1997). It has special limitation and metrics such as Utilization of Bandwidth, Dynamic Topology Discovery, Cost of Network Links, Bandwidth Link Estimation and Packet Broadcasting. Wherefore backhaul networks are directly employed in wireless environment; the mobile backbone network has to be improved for bandwidth utilization.

Wireless Communication Networking is typically classified into two types (Lin and Liu, 1999; Royer and Toh, 1999): Cellular (One Hopping Network) and Wireless (Multi-Hopping) *ad hoc* network. The research study is focused on Wireless Network therefore the focusing has not given for cellular. Wireless *ad hoc* networks are defined as mobile distribution multi-hopping of wireless network and it does not have pre-determined topology and centralized control. Nodes of the *ad hoc* networks do not need wired connection for creating a network and establishing a communication (Haas *et al*., 1999). It uses in warfield communications, enforcement of law, catastrophe recovery (fire, earthquake, etc.) and navigation and rescue. Lately, it has been useful much in the civilian forums such as classroom teaching, IT centers, building construction sites and special events (program concerts and carnivals) (Lin and Liu, 1999; Pearlman and Haas, 1999). It has been borne of so many protocols whose performance and characteristics are compared from the study of Broch *et al*. (1998), Das *et al*. (2000), Royer and Toh (1999) and Schult *et al*. (1999). Although, there are some existing efforts surveying on the characteristics, application and communication protocols in Wireless Networks (WN), we have done the survey specifically for dynamic-centric bandwidth. Cooperative network is found as to suitable for opportunistic networks.

This survey addresses several issue's designs and its related techniques to describe the functions of the protocols in the network layer. We work on the network layer and different routing protocols categorize the various approaches of data routing. Moreover, we summarize the compare and contrast for network data routing protocols.

Corresponding Author: Bakkiam David Deebak, School of Computing, SASTRA University, Thanjavur, 613401, Tamil Nadu, India

RECENT METHODOLOGIES

The communication nodes of wireless multi-hopping networks could step-up the communication issues of reliability, energy consumption and latency. The improvement could be much elevated by mutual information sharing of networks. The objective was to minimize throughput transmission delay by the effective use of bandwidth.

Bandwidth estimation technique: It was provided of a novel technique that would determine which would participate on packet message deliver and these (Time Utilization, Energy Minimization, Bandwidth Estimation) would be allocated for each. The simulation revealed the result of distribution algorithm that were two and five percent less efficient than the centralized (Draper *et al*., 2008). When it is centralized, efficiency could be easily improved rather than of decentralized.

Techniques of bandwidth efficiency are also important for congestion less traffic engineering and good network planning support. Three metrics have been given importance in the existing measuring tools: network capacity, available bandwidth and bulk transferring capacity. At present, so many new features have been employed for estimating the region of region bandwidth and importantly those bandwidths could be altered as of the current need of that region. This improves the scalability of the network .

Convex optimization technique: For improving the radio resource utilization and avoiding the network congestion, a Convex Optimization Technique (COT) has been proposed. This technique minimizes the traffic delay and maximizes the total system capacity. Thus, COT is able to for load balancing of heterogeneous wireless network (Miao *et al*., 2012).

For allocating the resource of bandwidth and power, mobile wireless multi-user network terminals may not be efficient due to resource limitation. A technique of the suboptimization of greedy search shortest path algorithm has developed for solving the issue of admission control efficiently. The objective of the survey study was in (1) Maximize the users sum capacity; (2) Maximizing the Behavior of User Capacity Relates Worst Case and (3) Minimizing Cumulation of Power Consumption (Gong *et al*., 2011).

Resource sharing networking system: The goal of the Wireless Networks is to allow a set of shared resources to multiple nodes for transmission of data. Node may be competing/cooperate for achieving their objectives of group/individual. A mathematical tool in Gane Theory was developed to address the addressing the issues of Radio Distribution Allocation of Resources of wired/wireless networks, where an each wireless nodes has a role of making the decision not having the complete information of the requesting nodes. This research study was resolved the issue of uncertainty for radio distribution. The theoretical model of Bayesian Game was to solve the bandwidth distribution issue which would happen with multiple mobile nodes to compete for the resource sharing of bandwidth from the wireless access points. A resource distribution algorithm was proposed to observe other requirement of mobile nodes and its behavioral actions (e.g., speed of mobile nodes, ondemand of bandwidth resource) (Akkarajitsakul *et al*., 2011).

Mobile terminals were pressumed to have the capabilities of multi-homing features. It was considered the transfer bit rate of constant and variable. The novel technique which was proposed in this study work was to solve its utility problem of bandwidth maximization and to perform its allocation of resource for the satisfication of the MT requirement and it si according to its indeed requirement of service classes. Hence, it does not depend upon Central of Resource Mangaer. The Terminal of Mobile plays a significant play in operating the allocation of resources by the performance of resource coordination with different available access points of wireless networks' that are BSs/APs to satisfy its bandwidth requirements. Each mobile/non-mobile network node has priority mechanism in turn to prefer the higher priority for its sharing of network resources to the requesting subscribers than to the other users (Ismail and Zhuang, 2012).

This was investigated the problem of routing of packet flow and fairness of routing allocation for multihop mobile environment. It was proved using virtual network decomposition.

QoS provisioning packet rotuing system: To provide Quality of Service, interference aware based max-min fair bandwidth allocation algorithm was proposed. The proposed algorithm was outperformed the existing technique of improving the network qualities. They were shortening the deferrals, lessening the loss of packets and full bandwidth usage (Thulasiraman *et al*., 2011).

Cooperative forwarding had shown for yielding the data bandwidth and spectrum spectral impact even though it incurred power impact abided by the practicing of nodes. This considered a scheme called Exchange of Bandwidth (EoB) where the nodes information get exchanged by the consumption of bandwidth as to provide data traversing and power consumption during transition. As well as, this was considered of multiple nodes over a fading channel and uses a Nash Bargaining Solution (NBS) mechanism for the merits of EoF in terms of bandwidth and spectral impact (Zhang *et al*., 2010).

Bandwidth is a valuable resource and it has been a rare resource in wireless networks for delivering the internet based mobile services. Therefore an efficient bandwidth management plays an important role in determining network performance of any networks. Reservation of Adaptive bandwidth resource and service borrowing algorithms were proposed for wireless multimedia networks. When conditional changes in dynamic network, proposed algorithm of control decisions was made to be an adaptive for balancing the wireless/wired network performance. This online approach in dynamic is to provide the features of adaptability, feasibility and efficiency for real-world wireless multimedia network operations (Kim, 2011).

The research study has realized the importance of bandwidth allocation and the region in where this research study will have the demand of bandwidth is expected to be distributed dynamically for achieving the good Grade of Services (GoS).

CLASSIFICATION OF ROUTING PROTOCOL

Different criteria of networks are for designing and classifying the protocol of the router. For an instance, What router is chosen for packet transit; when the router has started its packet transition; how many hops does the router have to do for exchanging the data packet. These details will be discussed in the following classification of routing protocol.

Routing-link state vs distance vector: LSR and DVS have two important for Wireless *Ad hoc* Network. In LS (Perkins and Bhagwat, 1994), the informations which are routed is to exchanges in the form of packets which is so called Link State Packet. It contains the information of the neighbors. Any changes in the network immediately cause the packets to flood into the entire network. Each node has a link with a global network topology from the LSPs which is then to receive and compete for routing the packets to all other nodes. The pitfall of LSR is that it can be incurred by excessive routing overhead whereof nodes move quickly and changes its topology as faster.

In DVR (Steenstrup, 1995), every node conserves of a distance which would include for packet traverse but would be restrained to, the triat (Receiver Identification, hop Info, (shortest path) distance) for every destination. Every node does distance updating as time to time with neighbors. If any nodes are updated by distance vectors from its neighbors, it should then compute for a new routes and updates its distance with a neighbor. When the complete information of the route is constituted, in the fashion of dissemination, it combines the hop information of nodes on the path of communication from the sender to the receiver. The pitfalls are, it convergences very slowly and it has a tendency of creating loops.

Pre-computed vs on-demand routing: Routing protocols mainly comprise of precomputed routing and on demand routing and it depends on whether the route is computed or not. The former is known as proactive or Table driven routing (Royer and Toh, 1999). This destination routing is computed in priori. In computing the network path in prior, nodes back-up the full or partial information about the states of the links and network environment. Nodes updates the information time to time or whenever the network changes. The merit is to when a source forwards the data to a destination, whose path has been already available, i.e., therefore it does not have the presence of jitter. The demerit, same path can never be employed at all time thus it lead into idle of the network.

The latter routing is known as reactive routing. Herein, the path to a destination cannot be existed in prior and it is examined time to time of the route which is necessitated. Its conceptual view is as follows. While a sender has of packet to forward to a another host, it would initially find a one or more path to delivering packets.This is called route discovery. In discovery, sender transmits packets along with its available paths. The merit is to improve the usage of bandwidth in any network environment and the allocated bandwidth is utilized well because of bandwidth usage; by constant monitoring of routes improves forward data traffic.

Periodic vs event-driven update: Node info has to prevail on to network nodes for ensuring that the knowledge network environment remains up-to-date. Based on disseminating, it may classify its routing protocols. The former Protocol disseminates periodically and it maintains the network stability. It makes the nodes realize the topology and the network state. Nevertheless if the updates were huge, it would not maintain the information up-to-date.

In the latter protocol, when a link down/appearing of new links; it updates or disseminates that information of available nodes. If the network topology changes rapidly, packet updates will be more by the use of bandwidth and cause too much fluctuation to the routes. The solution may be obtained from the concept of threshold values.

Flat vs hierarchical routing structure: In the former Routing, all network nodes present at the level which are of same and it has the unique routing. It is meant for the small networks where it can have simplicity and efficiency. The pitfall is that when it grows larger, the chunk of information will be scaled to huge and thus it process for a huge time to disseminate the packet to the remote end.

In latter routing, the network nodes are arbitrarily devised into partitions called clustering, then the clustering of nodes are accumulated once into huge partitions called superclustering. Constituting a network into a group which would aid to maintain a network stable.

Decentralized computation vs distributed computation: In the former computation, every node in the networks asserts the working environment such the node can seek the path to reach the destination when it is desired. Latter, nodes only assert in half and holds private information about the working environment. The route examined for node collaborating.

Source vs hop-by-hop routing: Its merit is that the nodes which are intermediate would not have to asserts update path information for the decision paths. In the latter, the source forwards the packet to the destination through one or multi-hop. The hop may be a destination or an intermediate node. If it is destination node then the next does not require otherwise it finds the other node for packet transferring. Likewise, the source packet reaches the destination. This methodology is employed in this routing technique. The pitfall is the communicators who need of maintaining the path information which has root looping.

Single path vs multiple path: Some routing protocols seeks one route from sender to a receiver which resultant is to simply the need of the protocol and saves the medium of space. Other path seeks more routes which are also having the merits of easygoing route recovery from a network down and this may have a fault tolerance. Moreover, the sender can select the best route for successful packet traversing.

COMPARISON OF ROUTING PROTOCOL

This survey study has done the intensive study for analyzing the routing protocols of wireless *ad hoc* networks. In this section, fifteen different routing protocols are compared with different criteria which are discussed in the section-III of this survey study. The protocols are: (1) Destination-Sequence Distance Vector (Perkins and Bhagwat, 1994), (2) Clusterhead Gateway Switch Routing (Chiang *et al*., 1997), (3) Dynamic Source Routing (Johnson, 1994, Maltz *et al*., 1999), (4) Protocol of *Ad hoc* On-Demand Distance Vector routing (Perkins and Bhagwat, 1994), (5) Protocol of Temporally-Ordered Routing Algorithm (Park and Corson, 1997), (6) Wireless Routing Protocol (Murthy and Garcia-Luna-Aceves, 1996), (7) Dynamic Source Tracing (Raju and Garcia-Luna-Aceves, 2000), (8) Associativity Based Routing (Royer and Toh, 1999; Toh, 1996, 1997), (9) Protocol of Signal Stability-based Adaptive Routing protocol (Dube *et al*., 1997), (10) Global State Routing (Chen and Gerla, 1998), (11) Fisheye State Routing (Iwata *et al*., 1999), (12) Protocol of Core-Extraction Distributed *Ad hoc* Routing Algorithm (Sivakumar *et al*., 1999), (13) Zone Routing Protocol(Royer and Toh, 1999, Pearlman and Haas, 1999), (14) Zone-based Hierarchical Link State routing (Joa-Ng and Lu, 1999) and (15) Hierarchical State Routing (Iwata *et al*., 1999).

Some technologies which often use distance vector or link state to wide-spread the packets and calculate link cost, it has accumulated the Protocol of Link State Routing and Protocol of Distance Vector Routing as for comparison. Each node has Storage Information. Nodes may have functionality which may be different in nature and therefore, saves the information. As to update, it is mainly necessitated for dynamic protocols configuration and it presumes the cost values such as periodical Updation/Routing Event-Driven/Hybrid Configuration. For the configuration of reactive protocols, when wired/wireless link is broken, packet routing maintenance enabled for providing the alternate route. This is called routing of an event driven maintenance. It is updated for improving the path reliability and finding the shortest. However, for route maintenance, if the Update Information is not properly done then it display "ROUTE-ERROR" message for updating the database of the Update.

Table 1 illustrates complexity analysis of typical routing protocol. The liken ramification of all aforementioned protocols and their relevant distinctions are made into four columns: Storage complexity reveals the storage size and it saves necessary information; control packet size differs for defined techniques; time complexity which shows the steps which is required for performing the protocol operation and communication complexity how many messages are needed for path operation Also, the values represents behavior of Worst-Case. Table 2 illustrates Network Structures of Typical Routing Protocol. This Table is divided of six columns. First column defines computation of routers as proactive, distributed and broadcast. Sec column defines network structures as flat and hierarchical. Third column defines routers as single and multiple. Fourth column defines source routing as yes/no. Fifth column defines Route Reconfiguration Methodology. Sixth column defines connection requirement as yes/no. Table 3 illustrates Topology and Updation Events of Typical

Table 1: Complexity analysis of typical routing protocol

Protocols	Complexity in storage (prefix 'O')	Complexity in time (Prefix 'O')	Packet size (prefix 'O')	Communication compexity (prefix'O')
Link state routing	(N×A)	(D)	(A)	(N)
Distance vector rotuing	(N)	(D)	(N)	(N)
Destination sequence distance vector	(N)	(D)	(N)	(N)
Gigabit switch router	(N×A)	(D)	(N)	(N)
Fisheye state routing	(N×A)	(D)	Fisheye determination	(N)
Clusterhead gateway switch routing	(2N)	(D)	(N)	(N)
Wireless routing protocol	(N×A)	(D)	(N+A)	(N)
Dynamic source routing	(D)	(2D)	(D)	(2N)
Ad hoc on demand distance vector	(D_d)	(2D)	(D_d)	(2N)
Temporally ordered routing algorithm	(D_d×A)	(2D)	(1)	(2N)
Synchronous data trafic	(D_d×A)	(2D)	(D_d)	(2N)
Area border router	(D+A)	(D+Z)	(D)	(N+Y)
Signal stabilityy based adaptive	(D+A)	(D+Z)	(1)	(N+Y)
Zone routing protocol	(M+B+$D_{d)}$	(M)/O (2D)	(M)/(1)	(M)/(2B+D)
Zone based hierarchical link state	(M+N/M)	(M)/(D)	(A)	(M)/(N)
Core extraction distributed *ad hoc* routing	(N)/(A)	(D)	(1)	(C+D)
Hierarchical state routing	(M×$\log_M$N)	(D)	(M)	(N)

M: Aggregation of mobile terminal nodes avaliability (zone clustering), N: Availability of network nodes, A: Aggregation of adjacent nodes, B: Aggregation of cluster border nodes, D: Networking diameter protocols, Y: Path directed-node availabilities and Z: Directed path diameter

Table 2: Network structures of typical routing protocol

Protocol	Computation of router P for proactive F dof distributed B for broadcast	Structure F for flat H for hierarchical	Routers S for M for single multiple	Source routing Y for yes N for no	RRM NA-not available RR for router repair	BR Y for yes N for no
Link state routing	P	F	S/M	Y	NA	N
Distance vector rotuing	P	F	S	N	NA	N
Destination sequence distance vector	P/D	F	S	N	NA	N
Gigabit switch router	P/D	F	S/M	N	NA	N
Fisheye state routing	P/D	F	S/M	N	NA	N
Clusterhead gateway switch routing	P/D	H	S	N	NA	N
Wireless routing protocol	P/D	F	S	N	NA	Y
Dynamic source routing	B	F	M	Y	RR	N
Ad hoc on demand distance vector	B	F	M	N	RR	Y
Temporally ordered routing algorithm	B	F	M	N	RR	N
Synchronous data trafic	B	F	S Or M	N	RR	N
Area border router	B	F	S	Y	RR	Y
Signal stabilityy based adaptive	B	F	S	N	RR	Y
Zone routing protocol	P	F	S/M	Y	RR	N
Zone based hierarchical link state	P	H	S	N	NA	N
Core extraction distributed *ad hoc* routing	P	H	S	Y	RR	Y
Hierarchical state routing	P	H	S	N	NA	N

RRM is used and it is expanded as route reconfiguration methodology, BR is a Initial connection requirement

Table 3: Topology and updation events of typical routing protocol

Protocol	Stored Information ET for entire topology DV for distance vector SS for signal stability	Updated period H for hybrid P for periodic ED for event driven	Update Information DV for distance vector RE for route error LS for link state RT for routing table	Update destination N, S sor neighbor and source	Method F for flooding B for broadcast U for unicast
Link state routing	ET	H	LS	N	F
Distance vector rotuing	DV	P	DV	N	B
Destination sequence distance vector	DV	H	DV	N	B
Gigabit switch router	ET	P	LS	N	B
Fisheye state routing	ET	P	LS	N	B
Clusterhead gateway switch routing	DV	P	DV	N	B
Wireless routing protocol	DV	P	DV	N	B
Dynamic source routing	DV	H	RE	S	U
Ad hoc on demand distance vector	ET AND DV	ED	RE	S	U
Temporally ordered routing algorithm	DV	ED	RE	N	B
Synchronous data trafic	SS	ED	RT	N	B
Area border router	ET	ED	NT	N	B
Signal stability based adaptive	ET	P	RE	S	U
Zone routing protocol	ET	P	LS	N	B
Zone based hierarchical link state	ET	P	LS	N	B
Core extraction distributed *ad hoc* routing	ET	P	DV	N	B
Hierarchical state routing	ET	P	LS	N	B

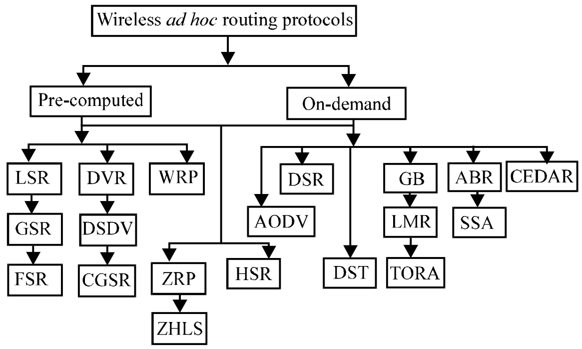

Fig. 1: Routing protocols of wireless *ad hoc* networks, LSR: Link state riuting, DVR: Distance vector routing, DSDV: Destination sequence distance vector, GSR: Gigabit switch router, CGSR: Clusterhead gateway switch routing, WRP: Wireless routing protocol, DSR: Dynamic source routing AODV: *Ad hoc* on-demand distance vector TORA: Temporally ordered routing algorithm, FSR: Fisheye state routing, SDT: Synchronous data traffic, ABR: Area border router, SSA: Signal stability based adaptive, ZRP: Zone routing protocol, ZHLS: Zone based hierarchical link state, HSR: Hiierarchical state routing, LMR: Label based multipath routing and CEDAR: Core extraction distributed *ad hoc* routing

Routing Protocol. This Table is divided of five column. First column defines topology information. Sec column defines topology updation periods. Third column defines nodes upadation. Fourth column defines methods of packet routing.

The fifteen routing protocols are apparently divulged in Fig. 1.

D_d: Maximum number of desired destinations,
#TORA: Has destination to traverse the packet,
##ZRP: Uses for message broadcasting and the zones overlap to avoid the connection disruption and
###CEDAR: Uses to broadcast message for core networks

CONCLUSION

In this survey study, a detail survey study of dynamic bandwidth allocation and its path setting criteria have been studied and examined. The survey work has shown a technique of Convex Optimization whereby the issues of Power and Network Resource Allocation could be sorted out for enhancing the network bandwidth utilization, network node life time and Good Service Rate (GSR) and Improving Service Satisfaction (ISS). A research on dynamic bandwidth allocation has not been grown much in the networking environment. It is even though so necessitated. Therefore, the preference has been given for the study work of the efficient bandwidth utilization through dynamic allocation.

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